

WASHINGTON

SCIENCE TRENDS

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Trends In the Making

- * Space Reorganization will, as previously reported, be recommended shortly by President Eisenhower. The President believes the space legislation now in effect "deficient in certain particulars." An effort to give the military a larger voice in space policy and programs, stemming primarily from the Air Force, appears to be succeeding in many respects.
- * Atlas program, which received a ringing endorsement from the President in his State of the Union address, will nevertheless be under close scrutiny from Congress. A number of Administration critics are now prepared to seize upon the Chief Executive's claims of accuracy for this ICBM.
- * Electronic Industry outlook for the year is "excellent" for all product lines, according to the U.S. Department of Commerce. Output is expected to reach the \$10 billion level for the first time. Consumer-type products are expected to increase by some \$250 million. Military and space equipment production is expected to grow by some 15 percent, while manufacturers of commercial and industrial electronic equipment can look forward to a 10 percent gain. Electron tube sales are expected to increase by 5 or 6 percent, although manufacturers of power, transmitting and special purpose tubes should do somewhat better. Semiconductor shipments are expected to show a 30 percent gain during the year -- healthy but well below the 75 percent rise in 1958-59.
- * Airborne Weather Radar will be mandatory on most of the nation's airliners, according to a new ruling of the Federal Aviation Agency. The deadline for installation on all pure jet and turbo-prop airplanes is July 1, 1960. A January 1, 1961 deadline will be in effect for the Douglas DC-6 and DC-7 and Lockheed 1049 and 1649 Constellations. An additional year will be permitted for such craft as the Boeing 377; Convair 240, 340 and 440; Lockheed 049 and 749; Martin 202 and 404 and Douglas DC-4. The FAA says it is convinced that such equipment is vital as a safety precaution in turbulent weather areas.
- * Government Research and Development: Another record Federal spending program for research and development, test and evaluation in a wide variety of civilian and military fields is now in prospect. Washington SCIENCE TRENDS will, on or about Jan. 18, report this program in detail in the popular Annual R&D Budget Survey.

High Speed Computer Program for Research

A general purpose program called Omniform I has been developed by the National Bureau of Standards through which researchers unfamiliar with programming techniques can employ high-speed digital computers for problem solving in a number of technical fields.

Problem: Omniform I was designed as a means of eliminating some of the delay caused by a wide variety of tedious computations required in various research tasks which, because of their temporary nature, are not usually programmed. The program was created primarily to meet the needs of workers in thermodynamics and molecular physics. However, the mathematical relations involved are said to be applicable to many fields of physics, chemistry and engineering where properties of materials or other tabular data are required as a function of one or two variables.

Solution: The program was designed to anticipate a wide variety of algebraic manipulations of the type performed in laboratories. The function types built into the program are identified and called for by numbers which are compared to "the stock numbers used in shoe stores to identify shoe styles". In addition, the scientist may supply the arguments desired, information concerning further manipulations, if any, on the functions generated, and instructions for the print format.

Function types presently built into the program include power series; natural and common logarithms; exponential terms and six trigonometric and six hyperbolic functions. Other functions, and various polynomials are planned for future inclusion.

Program Assembly was achieved through the use of the Fortran or Formula Translation automatic coding techniques and routines. In addition, specialized subprograms were developed to provide a complete program said to provide the utmost flexibility in input, computing and output capabilities. These programs are a permanent part of Omniform and provide a self-contained computing deck of about 500 binary punched cards, ready for immediate use. The entire deck can be read by the computer in two minutes, after which the computer is ready to interpret the 10 to 30 cards of input data which direct it to the individual problem.

Table Generator applications are the primary task of Omniform. Among tables which have been computed to date are; ideal gas thermal functions for neons and electrons, anharmonic corrections for diatomic molecules, vapor pressure of solid nitrogen, virial coefficients for nitrogen gas, negative exponentials corresponding to certain atomic energy levels, polynomial substitution, table conversion to other units, table editing and various mathematical tables for selected arguments. In a typical case, Omniform performed calculations which would have ordinarily required some 2500 program cards.

(Design by G. M. Galler, Computation Laboratory and J. Hilsenrath, Thermodynamics Group, National Bureau of Standards, Washington 25, D.C.)

Ocean-Going GEM

Operation over large bodies of water appears to be the most attractive possibility for ground effect machines (GEM'S) now under development in a number of industrial and Government laboratories. This view was presented before the Society of Automotive Engineers this week by Harvey R. Chaplin, a Supervisory Aeronautical Engineer for the Navy.

Performance: Current research indicates, according to recent studies, that large GEM's at moderate heights can provide several times better hovering performance than that of existing aircraft. Various calculations, largely theoretical, indicate that a well-designed GEM can be expected to cruise with an apparent over-all efficiency of slightly under 50 percent. No accurate means is said to exist at this time for the calculation of stability characteristics. However, the "likeliest" means of providing inherent stability appears to be through compartmentation -- the use of secondary jets exhausted from the base so as to subdivide the base into a number of cells -- each of which is sensitive to its height above the surface.

Size/Height Ratio is said to be the most dominant factor in estimating merits of various GEM systems. In practice, this is believed to mean that large size is required. However, extremely large GEM's may not be necessary if operating heights are kept to a "reasonable" figure.

This is said to be feasible in two classes of application:

*Land -- Over flat unobstructed land or marsh, inland rivers and small lakes, it might be possible to operate at heights of the order of one foot, permitting good performance with moderate-sized machines. Geographical considerations make it unlikely that this type of operation will be of great military or economic significance.

*Water -- Over large bodies of water it might be possible to operate at heights of the order of ten feet. This would permit attractive performance with large -- yet not unthinkably large -- machines. Further research, particularly in the area of stability and control, is said to be necessary to confirm and evaluate this possibility.

Flight Navigation Systems

Federal Aviation Agency has, in effect, vetoed the Decca Mark X navigational system for use as primary instrument flight navigation aid or for an air navigation steering device.

The Agency asserted that on 61 percent of the test routes flown pilots reported the equipment failed to provide the necessary navigation intelligence to use the system continuously as a primary IFR navigational aid. As a steering device, pilots were said to be unable to maintain a constant heading without the use of other instruments, or change to a new course.

Other asserted "major shortcomings" included losses of zone identification at intermediate ranges, deviations of the tracking pen on the flight log display and "cumbersome" control manipulation on 22 percent of the routes.

Research Checklist

- () Pulsejet Fog Generator: Navy has developed and tested a valveless pulsejet device for application as a fog generator. Manufacturing costs are expected to be low and the device contains no moving parts, simplifying maintenance and operational problems. It has been demonstrated experimentally that the device can burn either gasoline or diesel oil -- an important consideration since the use of gasoline on shipboard is considered a serious fire hazard.

(Technical Report to be published in the near future as NRL Report 5414 by Mechanics Division, Thermodynamics Branch, Naval Research Laboratory, Washington 25, D.C.)

- () Uranium-Molybdenum Alloys: Studies for the Atomic Energy Commission by Atomics International, Canoga Park, Calif., have resulted in the successful casting of uranium-molybdenum metal shapes of varying sizes and thicknesses from a molten charge. Specially designed graphite distributors and molds were employed. The method is suggested as a replacement for conventional fabrication techniques, which are said to be time-consuming, difficult and costly.

(Report available. 23 pages. 75 cents. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Report NAA-SR-4030)

- () Radiometric Sextant: Research and Development work has begun at AC Spark Plug, a division of General Motors on a radiometric sextant to be miniaturized for submarine installation. The device is designed to track radiation from the sun and moon to determine latitudes and longitudes. It is said to be capable of determining the direction of true north with at least five times the accuracy of any marine compass now in use and reportedly overcomes a major drawback of the conventional optical sextant -- which is "essentially useless" when the sky is overcast.

- () Synthetic Lubricants: Market studies by the U.S. Department of Agriculture indicate that diester-based synthetic oils now in use are not sufficiently serviceable for new engines now being tested by the military for application at speeds of Mach 2 and higher. It is reported that bulk-oil temperatures of 400° fahrenheit and above will be required, while the maximum heat-stability tolerance level of diester lubricants is said to be about 300° fahrenheit. The conclusion is reached that new base fluid materials will be required, not modification of present diester fluids that might be achieved by new or different additives.

(Report available. 29 pages. Single Copies Free. Write Information Office, Agricultural Marketing Service, U.S. Department of Agriculture, Washington 25, D.C. for AMS-353 "Market Potentials for Fats and Oils in Synthetic Lubricants and Lubricant Additives")

- () Metal "Sorting" Device: The thermoelectric effect is utilized in a new device which is said to be capable of sorting metals that look alike without costly, time-consuming and complicated testing. The tester differentiates between inconel and stainless steel, zircaloy-2 and zirconium and zircaloy-2 and hafnium -- non-magnetic materials used in naval reactor components. The device consists of a standard milliammeter with two leads -- one ending in a clamp and the other in a small carbon steel file. Rubbing the file against the sample produces a hot junction sufficient to produce a readily measurable and identifiable current. It is also suggested that the device may serve to determine the polarity of thermocouple leads.

(R&D by Mechanical Equipment Development Section, Knolls Atomic Power Laboratory, Operated by General Electric Co. for the Atomic Energy Commission)

- () Satellite & Booster Recovery: Wind tunnel investigations indicate to researchers at the NASA Langley (Va.) Research Center that it may be feasible to use small flaps attached to empty rocket booster casings for recovery purposes. According to this theory a flap located on the bottom surface of the casing can be deflected to generate lift which may be sufficient for an actual glide landing.

(Report available. 21 pages. Single copies free. Write NASA, ATTN: Code BID, 1520 H Street, N.W., Washington 25, D.C. for Technical Note D-170)

- () Low Temperature Thermometry: The National Bureau of Standards is expanding its low-temperature research program in hopes of increasing the precision of temperature calibrations from 90 down to 20°K, and providing a calibration service from 20 down to 2°K. In the lower ranges, the Bureau has been studying changes in the velocity of sound in helium gas as a function of temperature. Recently, it has been shown that for this purpose a nearly constant-temperature liquid helium bath can be achieved and associated with an extremely reproducible vapor pressure. It is also believed that both carbon and germanium resistors may be promising sources of secondary thermometers for use at low temperatures.

(Studies by Heat Division, National Bureau of Standards, Washington 25 D.C.)

- () Frequency Standard Research: Navy researchers have constructed a new atomic frequency standard employing recently-developed optical pumping techniques. The so-called gas-cell atomic frequency standard is said to be capable of providing a resolution of plus or minus one part in 10 billion. It is currently being used for research in the field of gas resonance, particularly the study of atomic-resonance effects in small glass cells containing alkali metal vapor. Work is expected to lead to small and easily carried atomic frequency standard.

Publication Checklist

- () Nuclear Fallout, the concluding volume, now available, of statements and exhibits presented to Congress in connection with last year's extensive hearings on radioactivity. Single copies free. (Write Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D.C., for Volume III, Fallout from Nuclear Weapons Tests)
- () Nuclear Process and Space Heat, a guide to 45 references to reports and published literature dealing with research, development and applications of nuclear process heat reactors. 7 pages. 50 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Publication TID - 3537)
- () Research and Development Funds, an analysis by the National Science Foundation of trends in research and development spending from 1953-59 by industry, government and research organizations. 8 pages. Single copies free. (Write Information Office, National Science Foundation, Washington 25, D.C. for Publication NSF-59-65)
- () Dosimetry, a survey by the Battelle Memorial Institute of current research and developments in the field of dosimetry. Current practices used in high-level dosimetry of gamma, neutron and mixed fields, are emphasized. A 1958 report, now generally available. 38 pages. \$1.25. (Write OTS, U.S. Department of Commerce, Washington 25, D.C., for Pub. PB 151 571)
- () Science Library, an annotated bibliography on books and magazines for the educational science library. 28 pages. Single copies free. (Write Publications Inquiry Unit, U.S. Office of Education, Washington 25, D.C. for Pub. OE-29002)
- () Thermoelectricity Abstracts, two volumes containing abstracts of unclassified literature on thermoelectricity research, development and applications. Volume I, 112 pages, \$2.50. Volume II, 81 pages, \$2.25. (Write OTS, U.S. Department of Commerce, Washington 25, D.C.)
- () Plastic Tooling, a report by the Army's Watertown Arsenal on the experimental use of an epoxy metal filled resin in metal forming applications. Satisfactory performance was said to be obtained from plates and clamps fabricated with the plastic tooling. 29 pages. \$2.70 in microfilm, \$4.80 in photocopy. (Write Photoduplication Service, Library of Congress, Washington 25, D.C. for Technical Report No. RPL-31/7)
- () Computer-Run Supply, a system reported by the Aeronautical Research Laboratory, Wright Patterson Air Force Base, Ohio, to have many advantages in the mechanization of base supply operations. A Material Information Flow Device, a medium-speed electronic data processor, serves as a central record-keeper. 177 pages. \$3. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 950)
- () Sounding Rocket, a technical report on the National Aeronautics and Space Administration's three-stage solid-fuel sounding rocket designed to carry an 81.5 payload to an altitude of 253 nautical miles. Vehicles were designed and built by the University of Michigan Research Institute. 25 pages. Single copies free. (Write NASA, CODE BID, 1520 H Street, N.W., for Tech. Note D-219)

